

In re application of MALVAR, H.  
Serial No: 09/955,577

**Listing of the Claims:**

1. (Currently Amended) A method for decoding video or image pixel data, comprising:

receiving a set of quantized coefficients;  
de-quantizing the quantized coefficients into transform coefficients; and  
applying an inverse transform process to the transform coefficients to reconstruct input pixel information therefrom, the inverse transform process applying inverse transformation calculations having values such that each multiplication operation can be performed by a shift operation, and wherein the inverse transform process corresponds to a two-dimension transformation using transformation calculations based on values represented in the matrix:

$$\begin{bmatrix} 1 & 1 & 1 & 1/2 \\ 1 & 1/2 & -1 & -1 \\ 1 & -1/2 & -1 & 1 \\ 1 & -1 & 1 & 1/2 \end{bmatrix}$$

2. (Original) The method of claim 1 wherein de-quantizing the quantized coefficients includes multiplying each quantized coefficient by a parameter selected from at least one table.

3. (Original) The method of claim 2 wherein at least two tables of parameters are accessible when decoding, wherein the coefficients are logically arranged

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in a block, and wherein for each quantized coefficient, selection of one of the tables is based on a position of that coefficient in the block.

4. (Original) The method of claim 3 wherein three tables of parameters are accessible when decoding.

5. (Original) The method of claim 2 wherein the quantized coefficients and parameter values enable de-quantizing in 16-bit arithmetic.

6. (Original) The method of claim 1 wherein applying an inverse transform process to the transform coefficients is performed in 16-bit arithmetic.

7-9. (canceled)

10. (Original) A computer-readable medium having computer-executable instructions for performing the method of claim 1.

11. (Currently Amended) A system for providing video or image data, comprising,

a block transform encoder, including:

1) a pixel transform process that applies a transform to input pixel information to construct transform coefficients therefrom, the transform

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process applying transformation calculations having values such that each multiplication operation can be performed by a shift operation; and

2) a quantization process that transforms the transform coefficients into a set of quantized integer coefficients;

a mechanism that provides the quantized integer coefficients from the block transform encoder to a block transform decoder; and

the block transform ~~encoder~~ decoder, including:

1) a de-quantization process that de-quantizes the quantized coefficients into transform coefficients;

2) an inverse transform process that reconstructs input pixel information from the transform coefficients, the inverse transform process applying inverse transformation calculations having values such that each multiplication operation can be performed by a shift operation, wherein the transform process corresponds to row transformation and column transformation processes, and 11 wherein the row transformation and column transformation processes apply transformation calculations based on values represented in the matrix:

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 2 & 1 & -1 & -2 \\ 1 & -1 & 1 & 1 \\ 1 & -2 & 2 & -1 \end{bmatrix}$$

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12-13. (canceled)

14. (Original) The system of claim 11 wherein the quantization process scales each of the transform coefficients by selecting a parameter from a table.

15. (Original) The system of claim 11 wherein the quantization process scales the transform coefficients, by, for each transform coefficient, selecting a parameter from a selected table of a set of three tables, the table being selected based on a relative position of the transform coefficient relative to other transform coefficients.

16. (Original) The system of claim 11 wherein the mechanism that provides the quantized integer coefficients includes an entropy encoder in the block transform encoder, at least one communication medium or device that logically connects the block transform encoder to the block transform decoder, and an entropy encoder in the block transform decoder.

17. (Original) The system of claim 11 wherein the de-quantization process scales each of the quantized coefficients by selecting a parameter from a table.

18. (Original) The system of claim 11 wherein the de-quantization process scales the quantized coefficients, by, for each quantized coefficient, selecting a parameter from a selected table of a set of three tables, the table being selected based on a relative position of the quantized coefficient relative to other quantized coefficients.

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19. (Original) The system of claim 11 wherein the inverse transform process corresponds to two-dimension column inverse transformation and row inverse transformation processes.

20 (canceled).

21. (Original) A method for decoding video or image pixel data, comprising:  
receiving a set of quantized coefficients;  
de-quantizing the quantized coefficients into transform coefficients; and  
applying an inverse transform process to the transform coefficients, the inverse transform process applying transformation calculations based on values represented in the matrix:

$$\begin{bmatrix} 1 & 1 & 1 & 1/2 \\ 1 & 1/2 & -1 & -1 \\ 1 & -1/2 & -1 & 1 \\ 1 & -1 & 1 & 1/2 \end{bmatrix}$$

22. (Original) The method of claim 21 wherein de-quantizing comprises,  
selecting each quantized coefficient, and for each selected quantized coefficient:  
selecting a table based on a logical relative position of the quantized coefficient relative to other quantized coefficients;  
looking up a parameter in the table that was selected; and

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scaling the quantized coefficient into a transform coefficient by multiplying a value of the quantized coefficient by the parameter and shifting the result at least one bit right.

23. (New) A method for encoding and decoding video or image pixel data, comprising:

applying a transform process to input pixel information to construct transform coefficients therefrom, the transform process applying transformation calculations having values such that each multiplication operation can be performed by a shift operation;

quantizing the transform coefficients into a set of quantized coefficients;

receiving the set of quantized coefficients;

de-quantizing the quantized coefficients into transform coefficients; and

applying an inverse transform process to the transform coefficients to reconstruct input pixel information therefrom, the inverse transform process applying inverse transformation calculations having values such that each multiplication operation can be performed by a shift operation, and wherein the inverse transform process corresponds to a two-dimension transformation using transformation calculations based on values represented in the matrix:

$$\begin{bmatrix} 1 & 1 & 1 & 1/2 \\ 1 & 1/2 & -1 & -1 \\ 1 & -1/2 & -1 & 1 \\ 1 & -1 & 1 & 1/2 \end{bmatrix}$$

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24. (New) A method for encoding and decoding video or image pixel data, comprising:

applying a transform process to input pixel information to construct transform coefficients therefrom, the transform process applying transformation calculations having values such that each multiplication operation can be performed by a shift operation;

quantizing the transform coefficients into a set of quantized coefficients;

receiving the set of quantized coefficients;

de-quantizing the quantized coefficients into transform coefficients; and

applying an inverse transform process to the transform coefficients to reconstruct input pixel information therefrom, the inverse transform process applying inverse transformation calculations having values such that each multiplication operation can be performed by a shift operation, and wherein the inverse transform process corresponds to a two-dimension transformation using transformation calculations based on values represented in the matrix:

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 2 & 1 & -1 & -2 \\ 1 & -1 & -1 & 1 \\ 1 & -2 & 2 & -1 \end{bmatrix}$$

25. (New) A method for decoding video or image pixel data, comprising:

receiving a set of quantized coefficients;

de-quantizing the quantized coefficients into transform coefficients; and

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applying an inverse transform process to the transform coefficients to reconstruct input pixel information therefrom, the inverse transform process applying inverse transformation calculations having values such that each multiplication operation can be performed by a shift operation, and wherein the inverse transform process corresponds to a two-dimension transformation using transformation calculations based on values represented in the matrix:

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 2 & 1 & -1 & -2 \\ 1 & -1 & -1 & 1 \\ 1 & -2 & 2 & -1 \end{bmatrix}$$

26. (New) The method of claim 25 wherein de-quantizing the quantized coefficients includes multiplying each quantized coefficient by a parameter selected from at least one table.

27. (New) The method of claim 26 wherein at least two tables of parameters are accessible when decoding, wherein the coefficients are logically arranged in a block, and wherein for each quantized coefficient, selection of one of the tables is based on a position of that coefficient in the block.

28. (New) The method of claim 27 wherein three tables of parameters are accessible when decoding.



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29. (New) The method of claim 26 wherein the quantized coefficients and parameter values enable de-quantizing in 16-bit arithmetic.

30. (New) The method of claim 25 wherein applying an inverse transform process to the transform coefficients is performed in 16-bit arithmetic.

31. (New) A computer-readable medium having computer-executable instructions for performing the method of claim 25.

32. (New) A system for providing video or image data, comprising,  
a block transform encoder, including:

1) a pixel transform process that applies a transform to input pixel information to construct transform coefficients therefrom, the transform process applying transformation calculations having values such that each multiplication operation can be performed by a shift operation; and

2) a quantization process that transforms the transform coefficients into a set of quantized integer coefficients;

a mechanism that provides the quantized integer coefficients from the block transform encoder to a block transform decoder; and

the block transform decoder, including:

1) a de-quantization process that de-quantizes the quantized coefficients into transform coefficients;

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2) an inverse transform process that reconstructs input pixel information from the transform coefficients, the inverse transform process applying inverse transformation calculations having values such that each multiplication operation can be performed by a shift operation, wherein the transform process corresponds to row transformation and column transformation processes, and wherein the row transformation and column transformation processes apply transformation calculations based on values represented in the matrix:

$$\begin{bmatrix} 1 & 1 & 1 & 1/2 \\ 1 & 1/2 & -1 & -1 \\ 1 & -1/2 & -1 & 1 \\ 1 & -1 & 1 & 1/2 \end{bmatrix}$$

33. (New) The system of claim 32 wherein the quantization process scales each of the transform coefficients by selecting a parameter from a table.

34. (New) The system of claim 32 wherein the quantization process scales the transform coefficients, by, for each transform coefficient, selecting a parameter from a selected table of a set of three tables, the table being selected based on a relative position of the transform coefficient relative to other transform coefficients.

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35. (New) The system of claim 32 wherein the mechanism that provides the quantized integer coefficients includes an entropy encoder in the block transform encoder, at least one communication medium or device that logically connects the block transform encoder to the block transform decoder, and an entropy encoder in the block transform decoder.

36. (New) The system of claim 32 wherein the de-quantization process scales each of the quantized coefficients by selecting a parameter from a table.

37. (New) The system of claim 32 wherein the de-quantization process scales the quantized coefficients, by, for each quantized coefficient, selecting a parameter from a selected table of a set of three tables, the table being selected based on a relative position of the quantized coefficient relative to other quantized coefficients.

38. (New) The system of claim 32 wherein the inverse transform process corresponds to two-dimension column inverse transformation and row inverse transformation processes.